DENTAL CROWNS

FIELD OF THE INVENTION

The present invention relates to tooth prostheses generally and more particularly to crowns.

BACKGROUND OF THE INVENTION

The following U. S. Patents and publications are believed to represent the current state of the art: 4,129,946; 5,487,663; 5,624,261; 5,709,548; 6,106,295.

SUMMARY OF THE INVENTION

The present invention seeks to provide a mass-produced, tooth colored pre-fabricated crown, particularly useful in pediatric dentistry for treatment of primary teeth and permanent molars having extensive carious lesions.

There is thus provided by the present invention a dental crown formed of a thermoplastic polymer material, said crown comprising:

a tooth shaped top surface; and

flexible side surfaces, at least one of which includes inwardly directed bottom portion.

In other words, at least one of the side surfaces defines an undercut.

The term *"undercut"* is used herein to indicate that the diameter of the outlet of the crown is reduced in comparison to the maximal internal diameter of the crown.

According to a preferred embodiment of the invention, the thermoplastic polymer material comprises a polymer selected from the following polymers: polyacetal, polyacrylate, polymethylmethacrylate (PMMA), polyamide, polyaryletherketone (PAEK), polyetherketone (PEK), polyetheretherketone (PEEK), polyetherimide (PEI), polyethersulfone (PES), polysulfone (PSU), and mixtures thereof. More preferably, the thermoplastic polymer is a homo- or co-polymer of acetal resin, polyetheretherketone (PEEK) or polymethylmethacrylate (PMMA).

According to another preferred embodiment of the invention, the thermoplastic polymer material further comprises at least one of the following: fibers, fillers, pigments and reinforcements. The fibers and fillers may be in their conventional or nano size.

A dental crown according to the present invention may be formed by several methods. Non-limiting examples of such methods includes injection molding, compression molding and machining.

According to a preferred embodiment of the invention, the dental crown is produced by mass production injection molding which comprises:

providing a multi-element mold; and

employing the multi-element mold to injection mold a dental crown from a thermoplastic polymer material.

Preferably, the multi-element mold includes an ejector, which is being operated to eject the molded crown following opening the multi-element mold.

BRIEF DESCRIPTION OF THE DRAWINGS

The present invention will be understood and appreciated more fully from the following detailed description, taken in conjunction with the drawings in which:

Fig. 1 is a simplified pictorial illustration of a dental crown formed of acetal homopolymer;

Fig. 2 is a sectional illustration of the dental crown of Fig. 1, taken along lines II-II in Fig. l; and

Figs. 3A, 3B and 3C illustrate the operation of an apparatus for manufacturing a dental crown from acetal homopolymer resin in accordance with a preferred embodiment of the present invention.

DETAILED DESCRIPTION OF THE INVENTION

Reference is now made to Fig. 1, which is a simplified pictorial illustration of a dental crown formed of acetal homopolymer resin and to Fig. 2, which is a sectional illustration of the dental crown of Fig. 1, taken along lines II-II in Fig. 1.

As seen in Figs. 1 and 2, there is provided in accordance with a preferred embodiment of the present invention an injection molded dental crown **10** formed of an acetal homopolymer resin. A preferred material for the crown is acetal homopolymer resin (DELRIN®) which is commercially available from DuPont.

As can be readily seen in Figs. 1 and 2, the dental crown **10** is formed with a generally conventionally tooth shaped top surface **12** and depending side surfaces **14** at least one of which defines an undercut **16**. Preferably, the depending side surfaces **14** are flexible. Crown **10** may readily be mounted, by conventional methods, such as through the use of dental cement in the mouth of a patient, typically a child, as part of treatment of primary teeth and permanent molars having extensive carious lesions. It is a particular feature of the invention that crown **10** is of a color which generally matches that of the patient's teeth.

The crown of the present invention is characterized by high tensile strength, high impact resistance and stiffness, excellent fatigue endurance and resistance to moisture, excellent dimensional stability and sufficient resilience and resistance to creep. It has the natural appearance of a vital tooth.

Reference is now made to Figs. 3A, 3B and 3C, which illustrate the operation of an apparatus for manufacturing a dental crown from acetal homopolymer resin in accordance with a preferred embodiment of the present

invention.

As seen in Figs. 3A, 3B and 3C, the crown **10** is molded in a mold cavity **20** which is defined by a top mold element **22**, a bottom mold element **24** and an ejector **26**. The ejector **26** forms part of an internal mold element **32**.

Fig. 3A shows the stage of molding when the top mold element **22** lies in tight engagement with the bottom mold element **24** and the ejector **26**. The dental crown **10**, which is fabricated on the ejector **26**, is formed by the injection of acetal homnpolymer resin material from a source of acetal homopolymer resin (not shown) into the mold cavity **20**, via a channel **30** cut in the top mold element **22**.

Fig. 3B shows an initial release stage wherein the bottom mold element **24** is separated from the top mold element **22**, thus permitting removal of the molded crown10 from cavity **20**.

Fig. 3C shows an ejection stage wherein ejector **26**, driven by a piston **28** moves upwardly relative to bottom mold element **24** and pushes crown **10** out of cavity **20**. Due to the resilience of the depending side surfaces **14**, the action of the ejector **26** is able to disengage the internal mold element **32** from the crown **10** notwithstanding the presence of undercut **16**.

It will be appreciated by persons skilled in the art that the present invention is not limited by what has been particularly shown and described hereinabove. Rather the scope of the present invention includes both combinations and subcombinations of the various features described hereinabove as well as variations and modifications which would occur to persons skilled in the art upon reading the specification and which are not in the prior art.